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ABSTRACT

Student ratings of dental hygiene clinical instruction were analyzed to determine dimensions of clinical instruction and the effect of the faculty's teaching philosophy on the underlying components of teaching. A 31-item student evaluation instrument was developed to reflect the teaching philosophy of the Department of Dental Hygiene, University of Maryland. Thirty of the questions dealt with the frequency with which certain teaching behaviors had been observed by students. Using a four-point Likert scale, students completed 682 evaluations over a 3-year period to evaluate 15 instructors. A principal components factor analysis with varimax rotation yielded two factors, accounting for 91.4 percent of the total variation of the data. The first factor, "behaviors influencing the development of critical thinking," contained 18 items. The second factor, entitled "behaviors influencing the development of clinical performance skills", consisted of 12 items. These factors are consistent with the recent adoption by the faculty of an inquiry philosophy of teaching. Factor analysis appeared to support the notion that students value most highly those faculty behaviors that facilitate the development of critical thinking and to a lesser extent those that influence the development of clinical performance skills. A 29-item reference list concludes the document. (SW)

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THE UNDERLYING COMPONENTS OF CLINICAL TEACHING

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ABSTRACT:

The purpose of this study was to determine, through analysis of student ratings, the dimensions of dental hygiene clinical instruction. Using a thirty-one item evaluation instrument, students completed 682 separate evaluations over a three year period. Fifteen different instructors were evaluated. The data was analyzed utilizing a principal components factor analysis with varimax rotation. This analysis yielded two factors, accounting for 91.4% of the total variation in the data. The first factor, "Behaviors Influencing the Development of Critical Thinking", contained eighteen items. The second factor was entitled "Behaviors Influencing the Development of Clinical Performance Skills." Twelve items loaded on this factor. These factors are consistent with the recent adoption by the faculty of an inquiry philosophy of teaching. Cultivation of critical thinking skills and development of student clinical skills are major goals of the curriculum.

THE UNDERLYING COMPONENTS OF CLINICAL TEACHING

Student evaluation of classroom teaching has become a routine procedure in dental and dental hygiene educational programs. Less frequently evaluated by students is faculty skill in clinical teaching. Because evaluation of didactic teaching is fairly common, research in the area is quite extensive. (1-5) Research concentrating on student evaluation of clinical teaching skills is, however, rare. (6-11)

One commonly used tool in research on student evalution is factor analysis. Factor analysis is a statistical method used to simplify a complex behavior, such as teaching, into a few basic dimensions. When the instructor is aware of the underlying components of teaching, she is better able to proceed with efforts to improve those skills and therefore improve her overall teaching behavior.

Among the most commonly cited dimensions of didactic teaching, identified through factor analytic techniques, are organizational skills, rapport, teaching skills, and instructor characteristics. (12-17) Exploration of the factors inherent in pre-clinical dental education have identified orientation toward students and teaching style as important factors in the preclinical laboratory. (18) Again in a dental school setting, as a result of surveys of staff, faculty, and students rather than factor analysis, Evans and Massler listed four behavioral characteristics of effective clinical teaching. They were consistency and dependability in attendance, technical skill, clinical judgment, and professional habits. (3) In factor analytic research, factors basic to clinical teaching have been described by Mayberry as communication skills, interpersonal relationships, instructor availability, and rapport. (8) Myers found five factors of importance in clinical teaching in dentistry: evaluating student performance, maintaining conditions for clinical learning, consideration for students, application of knowledge of dentistry, and concern for teaching. (9) No research has been conducted in a dental hygiene program which specifically examined the dimensions of dental hygiene clinical teaching.

The underlying components of clinical teaching are of particular interest to the University of Maryland's Department of Dental Hygiene because of its recent adoption of an inquiry philosophy. (19-22) The following excerpt from the Department's Philosophy statement captures the essence of what the faculty are hoping to accomplish.

> "The faculty are committed to creating an educational environment that will facilitate the development and cultivation of critical thinking, responsible professionals capable of realistically assessing their own performance and thereby directing their own professional growth and development during and beyond the educational program at the University of Maryland."

Educational research by Dewey, Bloom, Dressel and others has demonstrated that the process of critical thinking or evaluative thought, which is defined as the cognitive activity required to solve problems, make decisions or judgements and generate creative ideas, can be learned if learning experiences are designed to develop this type of thinking. (23) In addition, educational research has supported the concept that students can perform at higher conceptual levels if they have a heightened awareness of their cognitive or thinking process and if they feel they have the opportunity and responsibility to monitor, evaluate, direct and improve their own learning. (24-26)

The department faculty believes that one of the primary challenges for dental hygienists is to identify and help each patient to value and act on an informed understanding of the individual's responsibility for his own oral health. Consequently, dental hygienists who are able to plan their patient care based on a synthesis of sound and current biological findings and an individualized assessment of each patient's uniqueness, will be better suited to providing high quality dental hygiene care over the life time of their professional careers.

The purpose of this study was then not only to determine, through analysis of student ratings, the dimensions of dental hygiene clinical instruction, but also to see if the philosophy of teaching held by the dental hygiene faculty had an effect on the underlying components of teaching as revealed through factor analysis.

METHOD

A thirty-one item student evaluation instrument was developed to reflect the teaching philosophy of the Department of Dental Hygiene, University of Maryland. The first item on the questionnaire, used as a partial determination of the validity of the students' ratings, asked how often the student had worked with the instructor. The remaining thirty questions dealt with the frequency with which certain teaching behaviors had been observed by students. Student response was on a four-point Likert scale. Items were stated about equally in positive and negative directions to control for halo effects.

Evaluation of clinical instructors occurs yearly. Ratings are completed by junior and senior students in the presence of the school's evaluation specialist. The data used in this analysis included 682 separate evaluations collected over a three year period. Fifteen different instructors were evaluated during this time.

The data was analyzed utilizing a principal components factor analysis with varimax rotation. (27-29) An eigenvalue of one was used as the criterion for determining the number of factors to extract. The eigenvalue is defined as the measure of variance accounted for by a particular factor. (28, p.76)

Factor analysis is a statistical method used to achieve data reduction. It serves to simplify complex concepts into simpler descriptions. Through statistical techniques, an entire data set is reduced to a limited number of basic dimensions or factors. It is easier to analyze, discuss, and compare clinical teaching on a few dimensions than on the hundreds of possible behaviors that could be used to describe it.

Once factors have been determined statistically, it must be decided which items relate to the various factors. The items most closely identified with each of the factors are revealed by their factor loadings. The factor loading represents the correlation between the item and the underlying dimension. It measures which items contribute to which factors and to what degree, indicating the closeness of the relationship between the item and the factor. (27) In order to eliminate items loading on more than one factor and to simplify interpretation, loadings of .30 and greater were interpreted in this study.

When factors have been identified, and the items loading on that factor determined, the researcher tries to define the underlying psychological entity described by that factor. This is done by trying to determine logical connections between items that load on the same factor. Using this statistical process, the underlying dimensions of clinical dental hygiene teaching were developed.

Instructors vary in how they are rated by students on each of the items and resultant factors inherent in the evaluation questionnaire. Factor analysis not only attempts to reveal the underlying dimensions of a set of data, but also to indicate the relative contribution of each of these dimensions to the total teaching behavior. It measures the amount of variance in the data accounted for by each of the factors. After factors were determined for clinical teaching in dental hygiene, the researchers assessed the extent each of these factors contributed to clinical teaching.

RESULTS

Factor analysis yielded two factors with an eigenvalue greater than one. The total amount of variation accounted for by the two factors was 91.4% (Table I).

The first factor, labeled "Behaviors Influencing the Development of Critical Thinking", contained eighteen items with factor loadings ranging from .74 to .32 (Table II). The percent of variance accounted for by this factor was 80.9% (Table I).

The second factor was entitled "Behaviors Influencing the Development of Clinical Performance Skills". Twelve items loaded on this factor, with factor loadings ranging from .73 to .36 (Table II). For this factor, the percent of variance accounted for by the set of items was 10.5% (Table I).

DISCUSSION

The items loading most heavily on the first factor, "Behaviors Influencing the Development of Critical Thinking" were 31, 6, 8, 3, 17, 19, 5, 12 & 2. Most of these items had strong factor loadings. They seem to concern the instructor's ability to help the student develop, through the use of verbal communications, critical thinking skills which impact on patient care. More pointedly, items 6, 8 & 12 reflect behaviors that encourage students to develop the self-assessing component of critical thinking. Three items (10,27 & 30), also with high factor loadings, dealt with written comments. These written communication processes were structured by the department to foster critical thinking.

The remaining items (14, 13, 26, 20, 22 & 24), most with weaker factor loadings, related to the quality of the student/faculty relationship. Items 14, 13, and 20 addressed the student's perception of the faculty member's demonstration of concern, respect, interest and enthusiasm. It appears the students were supporting the educational notion that the environment created by the faculty member is an important element in facilitating critical thinking. Items 26, 22 and 24 have loadings below .52 and basically address availability issues which influence the learning environment and the subsequent student/faculty interactions but have less direct impact on facilitating critical thinking.

The second factor, "Behaviors Influencing the Development of Clinical Performance Skills" included items pertaining to teaching behaviors which have a direct impact on the quality of student performance in the clinical setting. (7, 9, 16, 23, 11, 4, & 2).

Whereas 7, 9, and 16, dealing with problem-solving and questioning, would appear to influence the development of critical thinking and fall under factor 1, students seemed to be more concerned about the direct impact that these behaviors could have on their ability to provide quality care for their patients. The remaining items dealt with potentially anxiety laden inter-personal relationships. Some items dealt with faculty/patient interaction (18 & 15) and others dealt with faculty/student interaction (16, 21, 29, & 25). Apparently these instructor behaviors impacted on the student's ability to perform clinical procedures.

One question appeared near the bottom of both factor listings. Question two ("Explanations are confusing") seemed to detract from both the development of critical thinking and from clinical performance skills. In contrast, only one question (28) did not appear on either of the factors. That question ("The instructor evaluates my performance more leniently than other instructors do.") perhaps did not load heavily on either factor because students traditionally either do not feel that faculty members can be too lenient in their assessment of students or the students did not recognize that leniency had occurred.

In this study, 81 percent of the rotated variance was accounted for by items pertaining to behaviors influencing the development of critical thinking. The Dental Hygiene department believes that critical thinking is a crucial attribute of a health care professional. Student ratings confirmed the success of this educational emphasis when evaluations showed this factor to be dominant.

The factor accounting for the second highest amount of variance was devoted to behaviors influencing the development of clinical performance skills. This factor accounted for almost 11 percent of the total variance. Learning clinical performance skills is, of course, a necessary objective in any hygiene program.

However, the faculty believe that education should be more comprehensive. Students must be helped to develop the thinking processes required to synthesize and integrate a broad array of information that is based on both biological and scientific

principles as well as individual patient variables. Based on this critical thinking, the students are then better prepared to initiate the dental hygiene process of care which includes goal setting, planning, implementation and evaluation. In addition, the students learn to begin to critically and realistically assess their own professional behaviors and take the actions required to strengthen and improve their provision of individualized patient care.

Therefore, the relative importance of these two factors in the student's overall evaluation of faculty teaching skills seemed to reflect the department's philosophy. Altogether, the two factors accounted for over 91% of the total variance in the set of data. That left only nine percent unexplained. Very little variation in the way students evaluated facutly members was left to variables other than those measured by the two factors and to chance.

What meaning can be attached to the information resulting from this study? What practical use can be made of the results? For the dental hygiene department, the study confirmed the success of their efforts to teach with their particular philosophical approach. Even when evaluating teaching behaviors, students were influenced by the underlying philosophy of education held by the faculty.

Factor analytic information can serve a second function. Evaluation feedback to faculty, in the past, has merely reported student response to individual items. With the results of the study as supporting evidence, the factors may now be used as summary feedback to faculty on their ability to acheive the two departmental goals; facilitating the development of students' critical thinking processes and clinical performance skills. Besides reporting to faculty average student responses to each item, the factor analysis suggested that mean student responses over all items in a factor would provide valid feedback from students on these two teaching goals.

One qualification must be mentioned. The results of a factor analytic study depend on the data entered into the analysis and the interpretation of the underlying factor dimensions. Further research needs to be conducted to determine if the items

used in this study affected the results. Halstead stated that rating form items should be consistent with a department's particular model of instruction.(30) Many different questions can be used to evaluate the behavior of teachers using the inquiry philosophy. Other questions using different wording fo the same concepts and describing additional teaching behaviors should be used in evaluation of the same departmental faculty. This would enable verification of the two factors reported in this study.

CONCLUSIONS

Factor analysis of student evaluations of the clinical teaching of dental hygiene faculty appeared to support the notion that students value most highly those behaviors on the part of faculty that facilitate the development of critical thinking and to a lesser degree those that influence the development of clinical performance skills. Inherent in both of these factors are behaviors that relate to the learning atmosphere and faculty/-student and faculty/patient interactions; both of which are influential in developing critical thinking processes and clincial skills.

This factor analysis provides statistical results which support that the University of Maryland faculty are, as their philosophy statement expresses, "creating an environment" conducive to student development of critical thinking and clinical skills. Students appeared to be aware, as supported by their evaluations, of the importance of enabling students the opportunity to think through a problem or challenge by means of carefully framed verbal and written communication that does not arouse anxiety.

Table I. Eigenvalues And Relative Weights Of Two Clinical Teaching Factors

Factor	Eigenvalue	Percent of Variation Accounted For	Cumulative Percentage
1	13.17	80.9	80.9
2	1.71	10.5	91.4

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Table II. Varimax Rotated Factor Pattern of Student Evaluation of Clinical Teaching

FACTOR 1: Behaviors Influencing the Development of Critical Thinking

The Instructor:	Factor Loading
31. Challenges me in a way that facilitates my learning.	.74
14. Shows a genuine interest in working with me.	.74
6. Provides guidance in analyzing and improving my performance.	.71
8. Helps me to identify my strengths.	.70
3. Explains in a way that facilitates my learning.	.68
10. Provides meaningful written documentation of my performance.	.68
13. Treats me with respect.	.67
17. Is responsive to my needs.	.67
19. Is open to questions and discussion regarding my performance.	.64
5. Correlates basic sciences with clinical experiences.	.61
27. Evaluates my performance in a manner consistent with departmental guidelines.	.56
12. Helps me to identify my weaknesses.	.54
26. Distributes her time fairly among assigned students.	.51
30. Is prompt in returning clinic records to me.	.46
20. Lacks enthusiasm when working with me.	.39
2. Explanations are confusing.	.36
22. Is available in clinic during scheduled hours.	.35
24. Informs me when she is leaving clinic temporarily.	.32

FACTOR 2. Behaviors Influencing the Development of Clinical Performance Skills

The Instructor:	Factor Loading
18. Discusses my performance in a way which arouses my patient's anxiety.	.73
7. Allows me time to work on my problems thereby encouraging the development of my judgment.	.70
9. Provides demonstrations only after I've had sufficient time to identify my problem.	.65
16. Encourages my questioning.	.63
21. Works with me in clinic in a manner which arouses my anxiety.	.59
23. Admits lack of knowledge when appropriate.	.54
11. Uses clinical skills that are consistant with those expected of me.	.49
29. Evaluates my performance more stringently than other instructors do.	.48
15. Demonstrates concern for my patients.	.47
25. Keeps me waiting unnecessarily.	.42
4. Provides information that is consistant with information given in lecture.	.40
2. Explanations are confusing.	.36

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